Claims

We claim:

1. An apparatus for separating molecules, said apparatus comprising:

a substrate having a surface;

a film in contact with said surface, and defining a substrate/film interface;

an electrode electrically connected to said film which applies a potential between said electrode and said substrate to form a depletion region in said substrate at said substrate/film interface; and

a photon energy source generating photon energy having an energy level greater than said potential, and directed at said depletion region to form electron-hole pairs in said depletion region, at least one of said electron-hole pairs being separated by said potential into an independent electron and an independent hole having opposite charges and move in opposing directions to create a photopotential in said film causing charged molecules in said film to move in response to the localized photovoltage, wherein one of said photon energy from said photon energy source and said substrate/film interface is movable relative to the other of said photon energy and substrate/film interface to scan said photon energy across said substrate/film interface at least once.

2. An apparatus as described in claim 1, in which said film comprises a material selected from a group consisting of polymethyl methacrylate and agarose.

3. An apparatus as described in claim 1, in which said photon energy source is a laser.

4. An apparatus as described in claim 1, in which said photon energy source produces a line of intense light to create a localized photopotential in said film.

5. An apparatus as described in claim 1 where the photon energy source is not constant.

6. An apparatus as described in claim 1, in said photon energy source is moved relative to the substrate/film interface to scan said photon energy across said substrate/film interface at least once.

7. An apparatus as described in claim 1, in which said potential is applied between said electrode and substrate using a potentiostat electrically connected to said electrode and substrate.

8. An apparatus as described in claim 1, in which said potential is modulated.

9. An apparatus as described in claim 1, in which said surface is artificially patterned to provide resistance to the molecular motion for separation.

10. The apparatus as in claim 1, in which said potential is less than 1KV.

11. The apparatus as in claim 1, in which said potential is less than 10V.

12. An apparatus as described in claim 1, in which the potential is alternated to create an alternating pulsed photopotential preventing the analyte molecules from adsorbing or depositing on either electrode.

13. An apparatus as, described in claim 1, in which the electrode is optically transmissive and electrically conductive.

14. An apparatus as in claim 1, in which said electrode is indium tin oxide.

15. An apparatus as in claim 1, in which said electrode is formed from a transparent insulating material having at least one surface coated by a film of a conductive material.

16. An apparatus as in claim 15, in which said insulating material is selected from a group consisting of glass and quartz, and said conductive material is selected from a group consisting of gold and platinum.

17. A method for separating molecules, said method comprising:

suspending analyte molecules in an electrically conductive film in contact with a substrate, wherein said film and substrate define a substrate/film interface;

applying a voltage potential across said substrate/film interface to create a depletion region in said substrate;

directing photon energy at a location in said depletion region to create a photopotential proximal said location in said film which causes said analyte molecules to migrate relative to said photopotential, said photon energy having an energy level greater than said voltage potential; and

changing the location in said depletion region at which said photon energy is directed to create a photopotential in said film and cause said analyte molecules to migrate in response to changing the location.

18. The method of claim 17, in which said photon energy is emitted by a laser.

19. The method of claim 17, including focusing said photon energy to produce a line of intense light directed at said depletion region to create a localized photopotential in said film.

20 The method of claim 17, in which said photon energy is not constant.

21. The method of claim 17, including moving at least one of a photon energy source emitting said photon energy and said substrate/film interface relative to the other of said photon energy source and substrate/film interface to scan said photon energy source across said substrate/film interface at least once.

22. The method of claim 17, in which said voltage potential is applied across said substrate/film interface using a potentiostat electrically connected to said electrode and substrate.

23. The method as in claim 17, including modulating said voltage potential.